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SIBLING SPECIES OF GREENLETS (VIREONIDAE) IN SOUTHERN BRAZIL

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ABSTRACT.—As was already evident in the first collections of the early 1800s, the Rufous-crowned Greenlet (*Hylophilus poicilotis*) of southeastern Brazil to Bolivia is sympatric in southern São Paulo with the Gray-eyed Greenlet (*H. amaurocephalus*) of eastern Brazil. The two differ in color of eye, beak, and head, and have different songs. Reports of intergradation were based on failure to detect the important differences, in part due to lack of time (=support) for taxonomy. *Received 25 Sept. 1989, accepted 6 March 1991.*

Birds often are considered to be well-studied taxonomically, with new species appearing mainly in little-visited places. Taxonomy based on intensive studies of museum specimens has, theoretically, brought us to the point where there seems to be little more to do. In the last few years, however, careful study of vocalizations and biochemistry has shown that unrecognized sibling species lurk even in such well-studied regions as North America (Johnson and Marten 1988, Groth 1988), Central America (Stiles 1983), and southeastern Brazil (Willis 1988).

Johnson et al. (1988), studying proteins in vireos (Vireonidae), confirmed large electrophoretic differences in morphologically similar forms. They predicted that the family might prove to be taxonomically undersplit. Recently, studying vocalizations and observing birds in São Paulo State, Brazil, I found that *Hylophilus poicilotis*, the Rufous-crowned Greenlet, found from eastern Brazil to Argentina, Paraguay, and Bolivia, is actually two species, the southern *H. poicilotis* and the northern *H. amaurocephalus* (presently *H. p. amaurocephalus*). The two are sympatric and differ in voice, eye color, and plumage. They had been separated earlier, but Todd (1929) was the last person to defend separation before Hellmayr (1935) and Pinto (1944a) thought they found intermediate specimens.

Voice.—On 18 December 1982, visiting a small woodlot reserve of the state forestry institute at Mandurí (Fig. 1A), southern São Paulo, I was surprised to hear a simple "sweet-sweet-sweet-sweet-sweet" song from a treetop bird that I eventually identified as a Rufous-crowned Greenlet (*H. poicilotis*). I knew "this" bird well from earlier studies in woodlots to the north (Willis 1979) where it was a forest-edge and scrub bird and sang a musical "tooweedy, tooweeder . . ." complex song.

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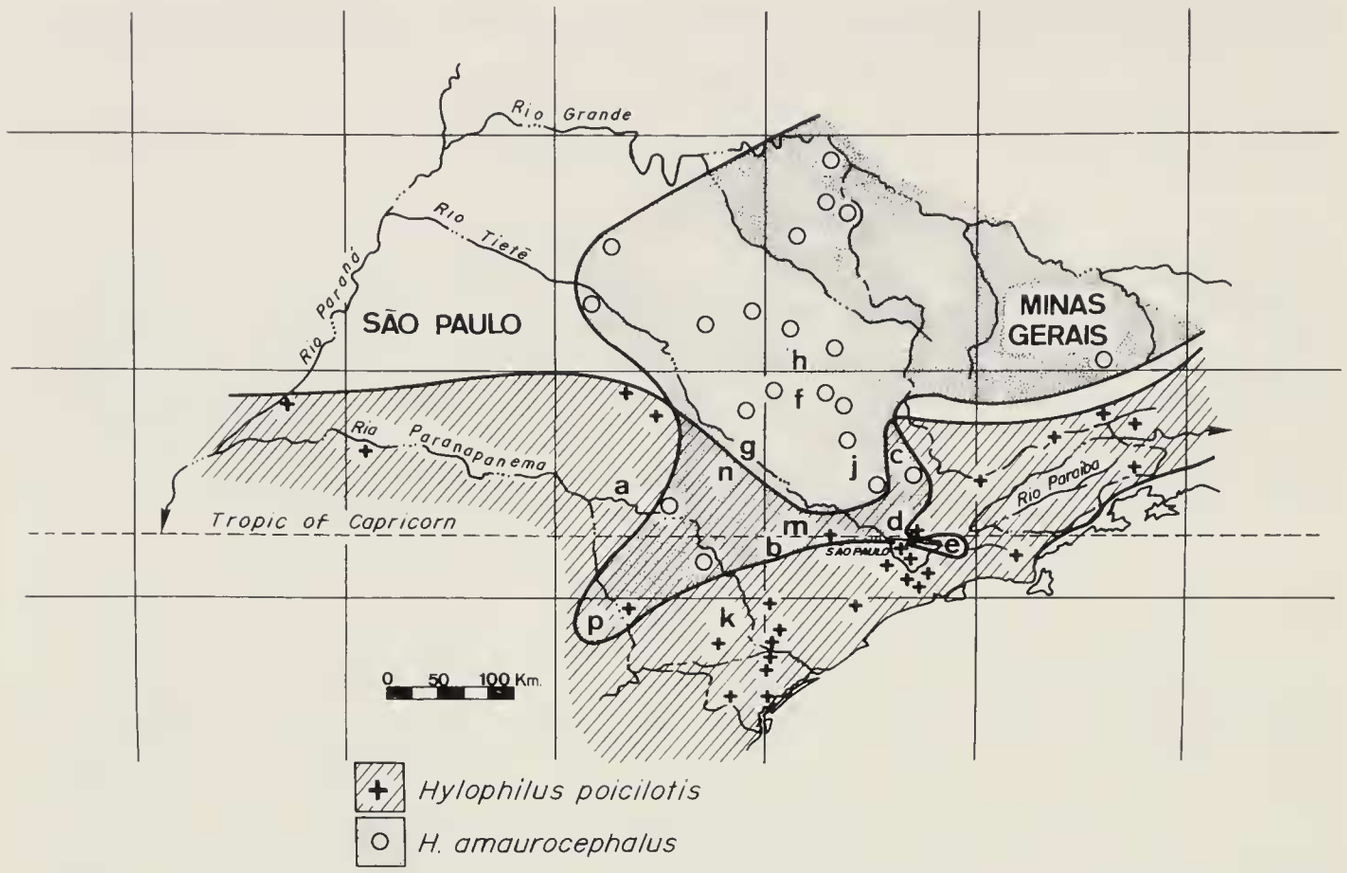

FIG. 1. Distribution of sympatric greenlets in São Paulo State. A. Mandurí. B. Itapetininga. C. Ibití. D. Terra Preta. E. Mogi das Cruzes. F. Corumbataí. G. Fazenda Barreiro Rico. H. Descalvado. J. Fazenda Santa Genebra. K. Intervales. M. Ipanema. N. Botucatu. P. Jaguaraiva, Paraná.

Further observation confirmed that the simple song (Fig. 2A, B) involved phrases that end on a high pitch and was confined to birds with a blackish ear patch in the humid and montane south and east of São Paulo. The complex song involved alternating phrases that end low (Fig. 2C) and was confined to birds with grayish faces in the mesic interior of the state. In the Museum of Zoology of the Univ. of São Paulo (MZUSP), I found that the blackish ear patch occurred in *H. p. poicilotis* and the grayish face in *H. p. amaurocephalus.*

Morphology.—The initial look at specimens in MZUSP indicated that the two forms were rather similar, as reported by Hellmayr (1935) and Pinto (1944a). After hearing the two song types a few meters apart (below), I returned to the MZUSP collection and found that there were constant differences in color, especially head color. Color of the underparts, suggestive of intergradation, depends to some extent on how much the preparator closed the skin. Hellmayr (1935) also emphasized the larger size of southern *H. amaurocephalus* as an approach to *H. poicilotis,* but approach in size may or may not indicate hybridization.

The Rufous-crowned Greenlet has yellowish underparts, a blackish

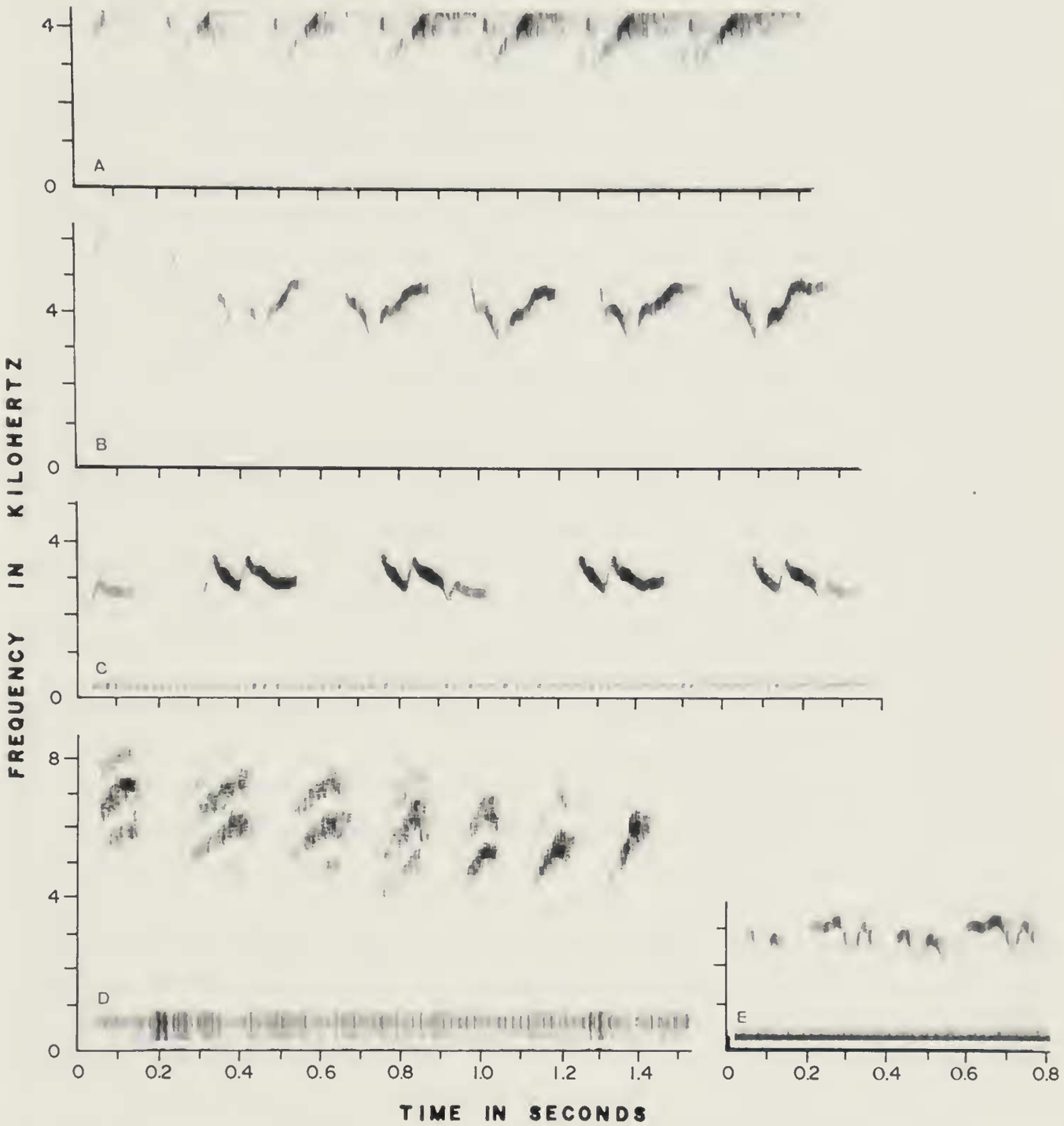

FIG. 2. Sonograms of *Hylophilus poicilotis* (A, "tweed, tweed . . ." song from Manduri; B, "tweedy, tweedy . . ." from Serra da Bocaina National Park) and *H. amaurocephalus* (Descalvado). C. "Chwee'erter . . ." song. D. "Jwai, jwai . . ." scolds. E. "Dee-terwee-ter-teebit" of presumed female.

auricular patch, and a grizzled, grayish face and forecrown. It has a short bill with dark maxilla and dark reddish-brown eyes. *Hylophilus amaurocephalus,* which may be called the Gray-eyed Greenlet, has a rufous cap extending to the bill, separated from the grayish face by a narrow but distinct pale grayish superciliary line. The auriculars are not dark, except in badly prepared specimens. The underparts are more buff than yellowish, except laterally. The bill is pale and long. The eyes are light or medium

gray. Hellmayr (1935) and other authors failed to note these differences, except for color of underparts.

Todd (1929) reported wing/tail differences denied by Hellmayr. Measurements of specimens from MZUSP do differ slightly (Table 1), notably that tail (center to tip) averages equal to the wing (chord) in *H. poicilotis* (N = 62, $t = 0.36$, ns) but almost 3 mm shorter than the wing chord in *H. amaurocephalus* ($t = 5.52$, $P < 0.01$). Since the wing and tail of *H. poicilotis* are about 55 mm and the wing/tail ratio of *H. amaurocephalus* is 56/53, the difference is not obvious; before statistical analysis, I thought Hellmayr correct. Wing and tail of small (ratio 51.6/48) *H. amaurocephalus* from northeastern Brazil also differ ($t = 4.92$, $P < 0.01$). In southeastern Brazil, its bill averages 0.2 mm higher at the front of the nostril, 0.45 mm wider at the gape angle, and 0.6–0.7 mm longer from the skull, while its tarsi are 19 and not 18 mm. Bill length, width, and tarsi of northeastern birds are about equal to *H. poicilotis,* but birds are smaller (wing, tail). Thus, relatively large bills, short tails, and long tarsi seem characteristic of *H. amaurocephalus* everywhere. Bills are significantly thick northward, especially considering the small measurements there.

Sympatry.—On 19 December 1986, at the reserve of the state Instituto Florestal at Itapetininga, southern São Paulo (Fig. 1B), I found the southern bird common in secondary gallery woodlands. A few meters away, in forest edge and bushy pastures, the complex song came from a single bird. This area had been studied for years for arboviruses by the Instituto Adolpho Lutz of São Paulo, with hundreds of captures of birds. Some specimens, mostly by Emílio Dente, eventually found their way into the collection of MZUSP in 1988. One specimen (64403), collected 2 August 1967 in the "orchard" nearby, is *H. amaurocephalus.* The rest (from the "second growth" zone) are *H. poicilotis.* Eye colors are correctly noted ("cinza claro" or light gray versus "marrom" or reddish brown).

Hellmayr (1935:159–160) found both types of greenlet (three of typical *H. poicilotis,* one of *H. amaurocephalus*) in J. Natterer's original collection of the early 1800s from Ipanema (now Varnhagen; Fig. 1M), plus one probable *H. poicilotis* that was "less yellowish" on the underparts and that he may have assumed was an intergrade. From Victoria (now Botucatu, Fig. 1N), he found one of each type. Southward, well in the range of *H. poicilotis* at Jaguaraiva, Paraná (Fig. 1P), he found one typical *H. amaurocephalus.*

Pinto (1944b) carefully studied specimens from Monte Alegre (now Ibití; Fig. 1C) without discovering that both *H. poicilotis* (Sítio Boa Vista, Fazenda Bom Jesus [mata], Fazenda Santa Izabel) and *H. amaurocephalus* (Chácara Bom Jesus, Fazenda N. Sra. Encarnação) were before him. The word "chácara" indicates a country house with a small orchard and per-

TABLE 1

MEASUREMENTS OF GREENLETS

	Wing[a]	Tail	Bill height	Bill length	Bill width	Tarsus
H. poicilotis			3.5 ± 0.22 (33)		7.7 ± 0.36 (47)	
Male	56.0 ± 2.11 (25)	55.6 ± 1.71 (25)		14.4 ± 0.51 (23)		18.2 ± 0.66 (25)
Female	53.4 ± 1.59 (26)	54.1 ± 1.91 (26)		14.0 ± 0.52 (23)		18.0 ± 0.64 (26)
H. amaurocephalus[b]			3.7 ± 0.22 (20)		8.2 ± 0.49 (20)	
Male	56.4 ± 2.11 (12)	53.7 ± 1.45 (12)		15.0 ± 0.51 (12)		19.2 ± 0.57 (12)
Female	55.3 ± 1.32 (9)	52.1 ± 1.17 (9)		14.7 ± 0.61 (9)		19.2 ± 0.61 (9)
H. amaurocephalus[c]	51.6 ± 1.38 (11)	48.0 ± 1.94 (10)	3.9 ± 0.18 (8)	14.0 ± 0.62 (12)	7.8 ± 0.35 (10)	17.7 ± 0.64 (12)

[a] $\bar{x}$ ± SD (in mm; N); nonsignificant differences between sexes shown only for bill length (*H. amaurocephalus*) and tarsi, where interspecific differences significant for males and/or females. Wing length not significant between males of the two species southward.

[b] S. Paulo, Minas Gerais.

[c] Bahia-Ceará.

haps scrub. "Mata" indicates forest, "sítio" a small farm between the size of a chácara and "fazenda" or ranch.

In MZUSP, other sympatric specimens of the two species are from Terra Preta and Mogi das Cruzes (Fig. 1D, E), so that the zone of sympatry passes across São Paulo, one of the world's largest although most deforested cities.

Habitat and habits.—H. amaurocephalus ranges from the dry woodlands of northeastern Brazil (Piauí, Paraiba) south at least to northern Paraná (Hellmayr 1935). It regularly occurs 1–10 m from the ground in scrubby, overgrown pastures and forest borders or irregular fire-burned woodlands; at times it sings in the forest canopy (observations near Murici, Alagoas), at least in regions where there are no *H. poicilotis*. The song near Murici and on the Chapada do Araripe, Ceará, is the same complex type as in São Paulo. Songs are more frequent in the morning and in the spring and summer.

It hops actively in dense foliage of branches or vines, pecking arthropods here and there; one at Corumbataí (Fig. 1F) got a spider from its web and held the prey in one foot while tearing it apart with the bill. Another bird at Fazenda Barreiro Rico, Anhembí (Fig. 1G) also held prey with the foot.

Birds normally occur in well-separated pairs, and the singing bird quickly comes to playback. The other (presumably female) then comes up and may give a special song (Fig. 2E). Both scold the observer (Fig. 2D). From 11:03 to 11:30, on 1 January 1989, in tall bush-overgrown abandoned fields near Descalvado (Fig. 1H), the presumed male sang faintly as he followed the female to and from a thin cup nest of green moss and white plant down, pendant 4.5 m in a forklet and a dense projecting tuft of leaves of a dense vine over a small tree. The male scolded, probably at me, as he hopped near the nest while the female sat and worked for long or short periods. At 11:30, a single visiting bird added a bit of down to the nest after scolds and a faint song; perhaps the male was helping. The bird(s) got material low in bushes 50–100 m away on several trips.

On 21 January 1978, a large young bird was fed out of the nest in Campinas (Faz. Santa Genebra, Fig. 1J). In the fall and winter, one often encounters groups of 3–4 birds, which are likely to be family groups. They regularly occur in mixed flocks but sometimes forage alone.

H. poicilotis ranges at least from the mountains of Espirito Santo (Santa Tereza, specimen in MZUSP; photographed in Dunning 1982) to Rio Grande do Sul and across southern São Paulo (Bauru and Porto Cabral specimens, MZUSP) to Argentina, Paraguay, and Bolivia. It occurs in the canopy and edges of humid or fairly humid forests, woodlands, and tall second growth, where it hops and pecks arthropods in fairly dense foliage. When bamboos occur next to dense dicot foliage, it hops in both, but it does not use bamboos otherwise.

Behavior and territory are much as in *H. amaurocephalus,* except that one ate some fruits of *Trema micrantha* (Melastomataceae) at Intervales (Fig. K) in March. Fruits were registered in stomachs of this or *H. amaurocephalus* by Schubart et al. (1965:222) and by Kuhlmann and Kühn 1947 (*Trichilia clausseni,* Meliaceae; specimens confirmed as *H. poicilotis* in MZUSP by collectors' numbers).

Belton (1985:166) saw one carrying green moss on 29 September 1975 in Rio Grande do Sul, suggesting that the nest may be mossy like that of *H. amaurocephalus.* A huge oven nest registered by von Ihering (1900: 205), of material of marsh plants, has almost no chance of belonging to a vireo. One often sees groups of 3–6 individuals in fall or winter, suggesting families with brood size larger than in *H. amaurocephalus.* The groups are often in mixed flocks. A faint "chek" or "chi-chek" goes between members of groups.

Discussion.—Sibling species, similar enough in morphology and behavior to confuse scientists or observers for many years, are well known. Polymorphism, in which birds of different morphology turn out to be the same species, is also rather frequent (but seems unlikely for these greenlets). Sibling and polymorphic species show that one can have significant genetic changes without morphological ones and vice versa. Although sibling species raise the specter of possible sympatric speciation, while polymorphs suggest that long geographic separation may have failed to cause speciation, one would need further evidence to prove either suggestion. Patton and Smith (1981) suggest, using electrophoresis, that geographical separation started long ago for two morphologically different pocket gopher populations that still interbreed, while rapid genetic divergence with recent geographic separation within one of the populations has produced siblings or "paraphyletic speciation." Avise et al. (1982) explained large electrophoretic differences in Vireonidae as a result of slow morphological change. One could argue that birds that depend on vocalizations to recognize their species (Tyrannidae, perhaps Vireonidae) might evolve different morphologies rather slowly, leading to sibling species. Johnson et al. (1988) suggested that overall changes in Vireonidae may occur at normal rates if they are undersplit taxonomically, perhaps due to taxonomic emphasis on plumages rather than on voice or other aspects.

The present case, in which birds considered subspecies turn out to be good species, indicates that Johnson et al. (1988) may be right about taxonomic undersplitting in vireos and that there may be other sibling species about.

It seems that sibling species can appear under the noses of active ornithologists. São Paulo is one of the most studied regions of Latin America, with large collections (see Pinto 1944a, 1978). The *Hylophilus* case here and another case in Formicariidae (Willis 1988) are surprising, consid-

ering that these birds are sympatric next to one of the largest cities in the world. Morphological differences that are obvious, once pointed out, completely escape one's attention in the field or in a museum tray. With little support for taxonomy, few persons spend much time on each study, resulting in superficial study of such birds as the greenlets. The number of cases of splitting and lumping in recent years, even in North America, suggests that birds may be well known, but not well enough. Alpha taxonomy is still needed.

Conservation.—Taxonomy has some relevance to conservation, especially when a species is split. Each form automatically gains a smaller range and a smaller world population. Few people worry about subspecies, especially in Latin America (Willis and Oniki 1982), compared to those who worry about "endangered species." When the different bird is not even recognized as a separate subspecies or population, the lack of attention is even worse (Willis 1988). Those who compose lists of "endemic" species sometimes consider world ranges in their decisions as to how many species are endemic in a certain area and hence how worthwhile a park may be in that area. If we oversplit some forms and undersplit others, we may protect the wrong areas.

In the case of the two species of *Hylophilus,* no immediate conservation problems are evident. The northern form survives in scrubby second growth. The southern one is less adaptable, more likely to lose wooded habitat, but it has a fairly wide range.

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